BOTANIST'S CORNER

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Flowers, Sex, and Hybridization in Carnivorous Plants

The flower is a remarkably specialized plant organ. It is characteristic exclusively of the Flowering Plants (Angiosperms) of which there are some 300,000 living on the earth today. They are by far the dominant life forms in most habitats, and they owe a large part of their success to the efficient functioning of the flower in sexual reproduction.

Sexual reproduction is important in the life of plants and animals because it allows for the combination of different genetic material from two parents into the offspring, creating a great deal of genetic diversity necessary for long term adaptation to continually changing and diverse habitats. Flower production is one of the most highly tuned and coordinated processes in the plant kingdom.

The flower is specifically designed to bear sex organs (male stamens, and female pistils) and to attract the insects (and other animals) so important for ensuring cross pollination. The large, colorful petals are the main attractive organs while nectar may also act as a lure and a reward. In order to be more successful with routine seed production and special attempts at hybridization of different species when dealing with our hobby of growing CP at home, it is desirable to understand how the flower works and what the possible arrangements can be.

The most desirable situation from the plant's point of view when engaging in sexual reproduction is of course for *outcrossing*, that is, for the *pollen* (containing sperm and produced by the stamens) of one flower to be carried to the *stigma* (receptive portion of the female pistil) of another flower on a *different* plant of the same species. This brings about the uniting of the most different genetic material from the parents to the offspring (seed). Most plants go to great lengths to ensure outcrossing; the following is an enumeration of the possible situations.

Flowers may be *perfect* (a single flower bearing *both* male and female organs) or *imperfect* (a single flower being either male or female, but not both). We will consider perfect flowers first:

PERFECT FLOWERS

Self-pollinating: while most plants want to cross-pollinate, if this does not happen, self-pollination may occur. This happens when the pollen is deposited on the stigma of the same flower. Self-pollination is usually a last resort when an insect does not come to transfer pollen to another flower; it ensures that at least some seed are produced for the next generation. Mechanically, this is accomplished by the movement of the stamens, or the stigmas, so that they come in contact with one another. You can do it with a small brush gently moved about inside the flower, making sure all stamens and stigmas are touched in the process.

CP which exhibit self-pollination are: (at least some) Sundews and Cephalotus (?). Some Sundews and very small Bladderworts may exhibit a type of self-pollination where the flowers never open. This is termed *cleistogamy*, and seed production occurs only by self-pollination. We do not know why this occurs, but it seems to be successful for the plants which exhibit it.

Cross-pollination may be ensured in two ways:

Self-incompatibility (genetic): this occurs when, even though both sex organs are produced in the same flower, the pollen will not function on the stigma of the same flower in which it was produced. Thus each flower can both give and receive pollen, but another flower must be involved in every case of successful seed production. There is usually a chemical factor involved which prevents "self" pollen from functioning. In some cases, two flowers on the same plant will be different enough genetically to cross, while in most cases, the two flowers must be on entirely different plants to overcome the genetic incompatibility factor. This implies that two plants which originally came from the same clump, or rootstock, even when separated and grown as individuals, will not produce seed when crossed. Each parent must be from a separate original plant, and not from a *clone*, or clump of vegetatively propagated individuals. This is the most common way of ensuring cross-pollination and is best exhibited by Venus' Flytrap.

While many CP can be self-pollinated by hand, cross-pollination is desirable and can be accomplished by taking pollen on a brush from one plant and gently brushing the stigmas of the flowers on another plant, and doing the reciprocal. Thus you cross-pollinate two flowers at the same time. There is very little knowledge about which CP are actually *self-sterile*, as it is termed. The more common situation is the following:

Mechanical prevention of self-pollination: In this case, the stamens and pistils of each flower are positioned in such a way that the stamens can never deposit pollen on their own stigmas--an insect (or human!) must intervene. Usually the flowers are irregular in shape and the stamens and pistils are hard to see; you almost have to dissect the flower to find them. Thus, hand pollination is difficult and practice is needed. In all cases, however, nature has "fixed" it so that certain insects are perfectly adapted to "fit" into each species of plant's flower. Thus, each size and shape of flower attracts a particular size and shape insect to pollinate it, sometimes exclusively. This keeps natural hybridizations between species to a minimum.

The CP which exhibit this situation are *Utricularia*, *Pinguicula*, *Sarracenia*, and *Darlingtonia*. Small bees and flies effectively pollinate the former two; while large bees, such as bumble bees, work on the larger flowers of the latter two. Very little work has been published on the pollination biology of CP.

To cross these types at home, you must first find the stamens, then transfer pollen by brush to the stigma of another flower on the same plant, or more likely, different plant (depending on whether or not that species is self compatible). *Sarracenia* are self-compatible. Try different combinations and keep records of your crosses and see what works.

IMPERFECT FLOWERS

Separate male and female plants: In CP, there is one situation where cross-pollination is absolutely ensured. This occurs in *Nepenthes* where the flowers on a given plant are *unisexual*, either male or female, but not both. The plants are thus either male or female. (In some other species of plants, the male and female flowers may be in different places on the same plant.) In *Nepenthes*, then, an insect *must* carry pollen from one plant to another. In nature this may sometimes present a problem if the two plants are not growing near one another; but usually the insect can locate the opposite sex with no trouble. In cultivation, it is another problem because female plants of *Nepenthes* are relatively rare; and when a grower has both sexes, they may not always bloom at the same time as they do in nature. When they do coincide, it is a simple task to transfer pollen. If you are dealing with the same species, or two species which are capable of hybridizing, good seed set should occur.

(To be continued)

In the next issue:

"Unseasonal Blooming in *Sarracenia* in Western Florida" by Landon T. Ross
"Of Barn Swallows and Droseras" by Owen Tallman
"Building Your Own Solar Water Distiller" by Scott A. Richardson
"Carnivorous Plant Companies" by Glenn Claudi-Magnussen
"Where We Came from and Where We Hope to Go" by Joe Mazrimas and Don Schnell

REVIEW OF RECENT LITERATURE

Casper, S.J. and K. Kondo. 1977. A new species of *Pinguicula* from Mexico. Brittonia 29:112-115.
Annual or bienniel *Pinguicula sharpii* (Sect. *Isoloba*, 2n=16) from Chiapas, Mexico is described for the first time. The plant is quite small and must be reproduced by seed.

Chhabra, S.C., Gupta, S.R., Seshadri, T.R. and Sharma, N.D. Chemical investigation of Dikamali gum: Isolation of two new flavones. Indian J. Chem Sect B Org. Chem Incl. Med. Chem. 14(9):651-653 1976.
Two new flavones were isolated from the above gum. One of them is isoscutellarein which was previously isolated from *Pinguicula vulgaris*.